

Research on the Method to Assure the Quality of Interdisciplinary Graduate Education

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Abstract: *The interdiscipline is an important carrier to cultivate the innovative capacity, and the graduate education is an important force to promote the construction of interdisciplines. How to establish a graduate education quality assurance system based on interdisciplines is essential to the cultivation of high-quality interdisciplinary graduates, the improvement of interdisciplinary education quality and the discipline construction of colleges and universities.*

Keywords: *Interdiscipline; Graduate education; Quality assurance*

1. Introduction

The discipline construction is the core of the construction of the colleges and universities. The graduate education, as a part of the discipline construction, is an important embodiment of discipline construction level. The recognition degree of colleges and universities for the discipline construction, the layout of interdisciplines and the occupation degree of the cross frontier of disciplines are key to the quality of interdisciplinary graduate education.

2. The construction of interdisciplines is essential to the improvement of graduate education quality

The interdiscipline is a new discipline generated through interpenetration and combination of different disciplines. For example, the biotechnology is a combination of biology and modern medicine and engineering technology. The construction of interdisciplines breaks the separation of original schools and departments, and creates an environment for communication and integration for the cultivation of creative talents, allowing the interdisciplinary graduates to develop in multiple dimensions with collision of creative ideas and cultivation of innovative capacity.

The construction of interdisciplines facilitates the optimization of knowledge structure of graduates. The interdisciplinary graduate education enables the graduates to master the knowledge of multiple disciplines, construct a relatively integral, comprehensive and reasonable knowledge structure, tap into their potentials, improve their overall quality and enhance their innovation capacity. The broad interdisciplinary knowledge allows the graduates to take advantages of different discipline thinking, and study methods, grasp the vertical and horizontal connections of knowledge, and obtain intuitions and inspirations through enlightenment and interaction between knowledge. The extensiveness, complexity and comprehensiveness of scientific and technological innovation entail the comprehensive usage of different knowledge, instead of one discipline of knowledge. The interdisciplinary graduates must possess the knowledge of multiple related disciplines, screen and integrate the knowledge, and continuously improve knowledge structure before they can make scientific and technological innovation by transplant, reference, improvement and innovation of concepts, thinking and research methods.

The construction of interdisciplines promotes the cultivation of innovative awareness of graduates. All kinds of creativity are conditional to creative thinking. No innovation will occur without strong creative thinking capacity. The interdiscipline concerns multiple disciplines. Different disciplines have different research methods and thinking modes. The construction of interdisciplines enables the graduates to break the traditional thinking patterns and explore new research methods and modes. The interdisciplinary research is a process that the researchers with different discipline backgrounds conduct knowledge connection, theory reference, pattern combination and method collision by use of the correction, integration and complementation of disciplines, to promote the scientific and

technological innovation through the integration, interaction and multi-directional communication of different disciplines. It is not limited by discipline boundary and traditional professions, neither constrained by one certain theory, technology or method. Instead, it promotes the solution of complex problems through cooperation, communication, induction, compensation and friendship. We should guide the graduates to conduct interdisciplinary research, to expand and diverge their thinking, and arouse inspirations and enlightenments, so that they can get rid of the constraints of fixed mindset, have new ideas and new thinking activities, achieve the innovation and breakthroughs of thinking patterns, observe, analyze and explore the inherent law of things from new perspectives and levels, and unveil the diversity and complexity of the understood objects^[1].

The integration of multiple disciplines is conducive to the cultivation of scientific and technological innovation methods of graduates. The innovation of research method is key to the scientific and technological innovation. For the scientific and technological workers, "the barrier to preliminary research lies in the lack of research methods". Because of the increasingly complex difficulties faced and coped with by scientific and technological innovation, innovations and breakthroughs cannot be achieved only by the traditional research methods of one certain discipline, and the improved and even comprehensive methods must be employed to make them possible. The graduates can refer to the theories and methods of multiple relevant disciplines, complement own shortcomings with the strengths of others, improve traditional scientific and technological innovation methods, or discover new and more effective methods. This is a bridge to innovation and lays a solid foundation for scientific and technological innovation^[2].

3. Method to assure the quality of interdisciplinary graduate education

The quality is the lifeline of graduate education. It is clearly pointed out in the *Opinions on Strengthening and Improving Graduate Education* of Ministry of Education that: "Place the ensuring and improving the quality of graduate education into a more prominent position." A sound quality management mechanism is the premise and guarantee for good operation of interdisciplinary graduate education. The Ministry of Education clearly stated in its "Opinions on Strengthening and Improving Graduate Education" that "ensuring and improving the quality of graduate education should be given a more prominent position." A sound quality management mechanism is the prerequisite and guarantee for the good operation of interdisciplinary graduate education. In practical work, we should earnestly research and explore the laws of interdisciplinary graduate education, create an environment that is conducive to the growth of interdisciplinary talents, and strengthen the graduate education based on interdisciplines, to deliver high-level innovative achievements in the interdisciplinary fields, while cultivating a batch of innovative talents that can fulfill the demands of national economy, science, technology and defence and participate in the international competition^[3].

Our graduate education has not developed very long compared to the foreign education. But with the rapid economic development and the implementation of "reinvigorating the country through science and technology" policy, the students participating in the examination for graduate education rise annually, and the graduate education has come to front. However, compared with foreign countries, China is facing various problems such as relatively low quality of education for all, insufficient funds, relatively poor teacher quality, non-uniform student background and imperfect graduate education mechanism. At present, how to establish a graduate education quality assurance system based on interdisciplines is essential to the cultivation of high-quality interdisciplinary graduates, the improvement of interdisciplinary education quality and the discipline construction of colleges and universities.

3.1. Reform the graduate enrolment system, and improve the candidate quality

We should allow the students from different disciplines and professions to take exams by properly setting the profession catalogue of interdisciplinary graduate enrollment, to improve the quality of interdisciplinary graduate candidates. We should encourage cross-discipline and profession enrollment, to integrate knowledge, theories, methods and technologies of different disciplines, and fully play the complementary and inspiring roles of theories, skills and methods of different disciplines, to improve the knowledge structure, thinking patterns, scientific methods and comprehensive skills of the interdisciplinary graduates, and enhance the scientific research quality and creativity. Pay attention to the connection with undergraduate programs, properly set the profession catalogue of interdisciplinary graduate enrollment, continuously make reforms on the premise of complying with the academic

degree regulations, and emphasize the quality education and capacity cultivation.

The cultivation stage of interdisciplinary graduates is not a concentration and reconstruction of undergraduates. We should pay attention to the combination of theory and practice, science and technology, pay attention to the basic level of undergraduates with the same academic qualifications who take exams for graduate education, strengthen the education of economic, management, and humanistic knowledge of interdisciplinary graduates, and advocate the cultivation of high-quality interdisciplinary talents with innovative spirits.

3.2. Adjust the course settings for interdisciplinary graduates

We should set up interdisciplinary graduate courses to change the following long-existing problems: narrow professional settings in graduate education. Most of the courses are professional compulsory courses, with fewer elective courses, especially for interdisciplinary and interdisciplinary students. The basic knowledge of the major is not solid enough, and the knowledge and ability structure is unreasonable. These courses are disconnected from production practice, and science education for liberal arts students is almost blank. Science students have poor humanistic qualities, which is not conducive to the improvement of their overall quality. Therefore, we should adjust the course settings of interdisciplinary graduates, optimize the organization of various courses to make them complementary to each other, and fully utilize the overall function of the course system, to gradually build and form a course education system that reflects the mainstream of disciplinary development and the needs of high-level talent cultivation, which are important issues that urgently need to be studied and solved in the comprehensive and innovative graduate education of colleges and universities.

In the course settings for interdisciplinary graduates, emphasis is placed on constructing courses that reflect the integration and knowledge penetration between disciplines, and adding high-level courses that reflect the forefront of technology and inspire innovative ideas, as well as comprehensive special lectures. We should add optional courses based on the research direction of the tutors, allow interdisciplinary graduates to freely choose courses across wider interdisciplinary categories, and promote interdisciplinary integration by flexible and diverse cultivation methods and diversity of cultivation objectives fitting the graduates, to help graduates transform their thinking patterns and get inspirations. We should guide graduates to continuously broaden their horizons while learning basic knowledge, and expose them to the research styles of different disciplines and tutors based on their choices, to lay the foundation for the formation of unique academic styles of interdisciplinary graduates, and cultivate their abilities to learn independently and make comprehensive research.

3.3. Establish a multidisciplinary shared experimental platform

A comprehensive experimental platform plays a crucial role in improving teaching and research levels, promoting disciplinary integration, and strengthening the cultivation of high-level innovative talents^[4]. Under the limited funds of the colleges and universities, the focus should be put on the hardware construction of the experimental platform, i.e., the purchase of advanced instruments and equipment. Relying on interdisciplines or major disciplines, related interdisciplinary forces and technological resources of the whole colleges and universities are integrated, to establish a shared experimental platform across schools, departments and disciplines. The experimental platform is centrally managed and used. Scientific research and technological resources are shared and open, to improve the utilization rate of instruments and equipment. The teachers' enthusiasm for scientific research in interdisciplinary fields is mobilized, to promote the improvement of the quality of interdisciplinary graduate cultivation and scientific research.

3.4. Strengthen the construction of interdisciplinary graduate tutor team

The level of knowledge, research ability, insight into the forefront of disciplines, and the ability to communicate with peers or other subject experts of interdisciplinary graduate tutors directly affect the quality of graduate cultivation. Firstly, we should determine the criteria for selecting tutors for interdisciplinary graduates, and provide institutional support for interdisciplinary recruitment of tutors. In scientific research planning, curriculum design, and personnel allocation, appointment and assessment, a certain amount of space should be reserved for interdisciplines, reducing the identity pressure of interdisciplinary researchers from the source disciplines^[5]. We should establish an effective selection system, with clear regulations on the research ability, academic achievements and moral standards of interdisciplinary tutors. When selecting and hiring interdisciplinary graduate tutors,

consider interdisciplinary research as an important indicator. Secondly, we should change the traditional cultivation patterns, and establish an interdisciplinary graduate cultivation mechanism consisting of expert tutors from different disciplines. We can develop a personalized cultivation plan for each newly enrolled interdisciplinary graduate based on their characteristics, and make overall arrangements for their learning; Meanwhile, we should assist graduates in constructing relevant disciplinary knowledge structures, select high-level interdisciplinary research topics, grasp research directions and progress, and be responsible for evaluating graduates' research achievements and academic level. In addition, we can combine the use and cultivation of tutors, cultivate more young teachers, and expand the interdisciplinary tutor team by various means. We can implement preferential policies, increase fund investment, encourage teachers to try to move cross disciplines, encourage young tutors to visit famous universities at home and abroad, apply for national level projects, and support tutors to participate in various academic exchanges and further education, to continuously improve their innovative quality and ability^[6].

3.5. Encourage graduates to conduct interdisciplinary scientific research

We should encourage graduates to select high-level interdisciplinary research topics from the forefront of science, conduct interdisciplinary research, and broaden their research ideas. Secondly, we can support graduates to participate in high-level academic activities both domestically and internationally, regularly organize lectures on the development status of academic frontiers and interdisciplinary exploration and research, promote the penetration between science frontiers and disciplines, and enable them to quickly access to and grasp the forefront of scientific research. In addition, we should establish necessary guarantee mechanisms to ensure the quality of interdisciplinary graduate theses. For example, we can provide special funds for graduates' interdisciplinary research to support potential interdisciplinary cutting-edge topics, and employ practical research projects to ensure the effectiveness and pertinence of interdisciplinary research topics of graduates, and ensure the quality of theses starting from the source of the thesis quality, requiring the topic selection and production of interdisciplinary graduate theses, etc. to reflect interdisciplinary characteristics or at least reflect interdisciplinary research methods and technologies^[7].

4. Several suggestions on the improvement of the quality assurance system of interdisciplinary graduate education

At present, the main models for ensuring the quality of graduate education in various countries include the intermediary agency led model represented by the United States and Germany; the government led model represented by Russia, France and Asian countries; and the collaborative model between the government and universities, represented by the UK. The quality assurance and practical models adopted vary with the national conditions of every country, with their own advantages and disadvantages. Drawing on the experience and characteristics of the quality assurance models of graduate education in these countries, this research suggests that the quality assurance mechanism of graduate education should adopt a diversified and composite model with joint participation, cooperation and complementation of the government, universities and society.

4.1. The government should transform its functions in the quality assurance system

4.1.1. Transform from "administrative management" to "policy regulation"

Under the conditions of market-oriented economy, the government should mainly regulate the market order rather than the market itself, and the government's focus should be put on the formulation of good market rules. Therefore, the government should establish and improve policies and regulations on the quality evaluation of graduate education, to define the legal status and respective rights and responsibilities of each quality evaluation subject, and standardize their evaluation behaviors, so that they can coordinate with each other, play their respective roles, and work together to ensure the quality of education. This not only improves the government's efficiency, enhances the transparency and binding force of quality evaluation, but also promotes the institutionalization and standardization of graduate education quality evaluation.

4.1.2. Transform from "centralized control" to "multilateral co-governance"

With the rapid development of higher education in China, there is a trend of diversified stakeholders of higher education, and the desire of each stakeholder to actively participate in the evaluation of the

operational efficiency and quality of graduate education is gradually becoming stronger. The graduates or potential graduates need reliable and sufficient information about specific cultivation institutions and their relative quality and status in favor of their interests, to help them choose universities and majors, and judge the possibility or degree of realizing their own interests; the social employers and other direct service recipients of graduate education, as well as direct or indirect investors, need to understand the quality of graduate education and the differences between different cultivation units, to achieve their interests or policy goals; and as taxpayers, the public has the right to understand and supervise the use of public resources, and to obtain relevant information on the quality of graduate education. All of these require the government to change the traditional government led quality evaluation model, and gradually establish a new model of multilateral co-governance with the participation and management of the government, universities, non-governmental organizations, social institutions, etc.

4.1.3. Transform from "supervision and control" to "effective service"

In traditional higher education management, the government usually manages colleges and universities by administrative means such as control, approval, supervision and punishment. It is accustomed to issuing orders in management. In the evaluation of graduate education quality, it is manifested in the relationship between the government as the evaluator and the colleges and universities as the evaluatees, namely the relationship between management and being managed, control and being controlled, command and obedience. The control function makes the colleges and universities difficult to play their main body role, and leads to their catering and passive response and even opposition between the evaluation parties. It can be seen that in the evaluation of graduate education quality, the government must shift its function from control to service. The government should provide support and services for higher education institutions, including certain funds and personnel training for the evaluation of educational quality of colleges and universities, the establishment of an evaluation information database, regular provision of objective information and data required for evaluation to colleges, universities or other social evaluation institutions, provision of consulting services for higher education institutions, and the construction an experience exchange platform for quality evaluation.

4.2. The colleges and universities should establish and improve internal quality evaluation mechanisms

Because numerous factors affect the quality of graduate education, the establishment of an internal education quality evaluation system in colleges and universities is a complex systematic project, and the construction of the following elements should be emphasized.

4.2.1. Concept elements

The concept elements mainly refer to the quality culture, quality awareness, etc. closely related to the quality of graduate education. The establishment of quality awareness of all personnel is foremost in quality evaluation. Quality awareness is not only about understanding and mastering the concepts and methods related to quality evaluation, but also about actively creating a cultural environment, including recognition of the organization's quality concept and objectives, employees' commitment to quality and pursuit of continuous quality improvement, the organizational image created by personnel at all levels, and effective collaborative relationships with the organizations outside colleges and universities.

4.2.2. Personnel elements

The personnel elements mainly refer to the main body that can reflect the quality of graduate education and relevant personnel, mainly including:

Graduate sources. Graduates are the direct objects of graduate education, and also the direct embodiment of the quality of graduate education. The quality and learning attitude of graduate sources directly affect the quality of cultivation. The quality of graduate sources is the foundation and prerequisite for the formation and improvement of the quality of graduate education, and selecting qualified students is the first step of education. The colleges and universities can adopt flexible and diverse methods within the scope allowed by national policies, and formulate different requirements and standards for student selection based on the characteristics and requirements of disciplines and professions.

Tutor team and academic echelon. Among various factors that affect the quality of graduate education, the tutor team is the most direct and critical factor. The tutor's words and deeds play a

crucial role in improving the academic level and knowledge structure of graduates. The professional characteristics of tutors, as "academic persons", determine that their achievement expectations are much higher than those of employees in other industries. On the one hand, the colleges and universities should regard academic standards as the foundation and important prerequisite for the construction of their tutor team, innovate scientific tutor evaluation and selection mechanisms, hire tutors strictly according to academic standards, and assess tutors strictly according to educational standards, to solve the problems of tutors only being able to "take office" and not being able to "be dismissed", and inadequate academic guidance from tutors for graduates. On the other hand, the concept of humanistic management should be introduced into the construction of the tutor team, advocating for flexible management and emphasizing emotional communication; advocating for leveraging team strengths and encouraging interdisciplinary approaches; and advocating for respecting the subjectivity of tutors and fully mobilizing the enthusiasm and initiative of tutors by flexible and diverse incentive methods.

Conditional elements. The funding investment and advanced hardware facilities for graduate education are the most basic and important material foundation for cultivating high-quality graduates and delivering high-quality research results. The conditional elements mainly include hard resources such as research laboratories, practical bases, teaching equipment, research instruments, books and materials, network resources, living environment and facilities.

The colleges and universities should actively expand channels such as national or local government investment, various scientific research projects, social funding and donations, to strive to attract resources from all parties, increase funding for graduate education, and improve the treatment of graduates, to create good material living conditions for graduates to study with peace of mind.

5. Institutional elements

5.1. Funding system

A reasonable and effective graduate education funding system is a powerful guarantee for mobilizing the learning enthusiasm of graduates, and enabling them to concentrate on their studies and scientific research work. The higher education institutions should establish a graduate funding system of various types including awards, assistance, work and loan. "Awards" refer to national scholarships and various special teaching funds; "Assistance" refers to the establishment of "three assistance" positions (research assistant, teaching assistant and management assistant) to enable graduates to receive all or part of their living subsidies while participating in scientific research, teaching and management work; "Work" refers to the use of work-study programs to cultivate the spirits of self-reliance and self-help of graduates, while improving their overall quality; "Loan" refers to the use of national student loans to enable financially disadvantaged students to complete their graduate studies.

5.2. Complete education process management system

"It takes ten years to grow a tree, but a hundred to cultivate a person". As the highest level of talent cultivation, graduate education should pay more attention to the cultivation of comprehensive qualities such as innovative consciousness, innovative spirit and innovative ability of graduates. Therefore, the higher education institutions should establish a complete process management model, formulate corresponding management rules and regulations, strictly control all links including graduate course system, classroom teaching, teaching management, academic exchange, project training, thesis selection, review and defense, degree awarding, etc. to effectively ensure the quality of graduate cultivation.

5.3. Elimination mechanism

The elimination system for graduates is an important part of internal quality management of colleges and universities. The graduate education in developed countries such as the United States is that the teaching content is characterized by very concise teaching content, which entails students to consult a large number of reference books and materials themselves. Exams focus on whether the students have a comprehensive grasp of the knowledge and research progress in their fields and related fields, and whether they have the ability to raise, analyze and solve problems. The elimination rate is generally 40% or higher. The colleges and universities should strictly enforce course assessment, thesis

review, qualification review and other procedures, and empower the thesis defense committee and degree evaluation committee, so that they can strictly review and decide whether graduates can graduate or obtain a degree according to academic standards, and eliminate interference from administrative power.

5.4. Self-evaluation mechanism of development quality

The effective internal quality evaluation mechanism of the higher education institutions is not only the foundation of national and social evaluations, but also an important guarantee for achieving self-restraint, self-supervision, self-improvement and self-development. The colleges and universities can conduct various forms of evaluations based on their own needs, such as comprehensive evaluation of the quality of graduate cultivation and the overall level of subject construction, and single-item evaluation of academic papers, curriculum design, textbook construction, teaching level, equipment management, degree awarding, etc. They should also establish corresponding evaluation institutions, and formulate corresponding rules and regulations, to ensure the smooth implementation of self-evaluation work.

6. Social forces should play a positive role in evaluating the development quality of graduate education

6.1. Establish social intermediary evaluation agencies

The evaluation of intermediary agencies is an important component of social evaluation. Establishing effective intermediary agencies which can fully play their roles is one of the symbols of healthy social development, and also an important way to achieve scientific and democratic management. By accepting the entrustment of evaluation, the intermediary evaluation agencies of graduate education make value judgments on the quality of graduate education, and contact the government, society, and degree awarding units in the way of evaluations, with relative independence. Intermediary agencies undertake various functions such as research, implementation, consultation and information services for graduate education evaluation. As a bridge between the government, society and graduate cultivation units, they help to promote the transformation of government functions and the decentralization of power; relieve conflicts between the government and cultivation institutions, and promote positive interaction between the government, society and graduate cultivation institutions; and strengthen regional and international evaluation cooperation, promote the professionalization of educational evaluation, and more effectively ensure the quality of graduate education.

6.2. Establish and develop graduate education industry organizations, and carry out industry self-discipline

In developed countries such as Europe and America, higher education industry organizations play a very important role in quality evaluation. They represent the interests of college and university members, play a role in protecting university autonomy, and also coordinate and constrain their educational practices, bearing the responsibility for the quality of the education industry. The functional advantages of industry organizations are mainly reflected in two aspects, namely provision of information and coordination of actions. In terms of information provision, the industry organizations can utilize the comprehensive information resources held by them to evaluate the reputation or quality of members, while also predicting and planning the overall development prospects of the industry. In terms of coordination, they can ensure consistency in internal and external actions of members, such as training organization, policy lobbying and joint litigation, highlighting its influence advantages in the formulation of relevant policies and external interactions.

7. Conclusions

In China, the role of various academic organizations such as academic groups, professional associations, educational societies, and educational guidance committees should be fully utilized, to participate in qualification certification, educational quality evaluation and other activities of various disciplines and professions in colleges and universities relying on them. The professional advantages of the academic community should be fully leveraged, and periodic or random educational evaluations should be conducted, to enable various industry organizations composed of experts and scholars to play

an important role in the evaluation of graduate education quality. Good autonomy and self-discipline are the foundation and prerequisite for independent education in colleges and universities. Industry organizations in graduate education should establish strict self-discipline mechanisms to safeguard the interests of individual members and the whole, optimize the development environment of graduate education, effectively influence government decision-making, promote sustainable development of the entire industry, and ensure the steady improvement of education quality.

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References

- [1] Li Liqin. *Research on the Cultivation of Innovative Talents through Interdisciplines [D]*. Master Thesis of Central South University, 2005
- [2] Wang Chuanyi, Wang Tao. *Evolution of Interdisciplines: Stages and Characteristics -- Discussion on the Development of Interdisciplines in the United States [J]*. *Degree and Graduate Education*, 2022 (9): 23-30.
- [3] Yang Chunren, Xie Huixiang, Gan Guolong. *Analysis of the Characteristics of Interdiscipline Setting in "Double First-Class" Universities [J]*. *Chinese University Science & Technology*, 2023 (7): 35-40.
- [4] De Jifu. *Correlative Characteristics of Independent Interdisciplinary Settings in Colleges and Universities [J]*. *Chinese Higher Education Research*, 2020 (6): 92-97.
- [5] Li Sen. *Educational Value and Implementation Strategies of Interdisciplines in the New Era [J]*. *Education Development Research*, 2022 (11): 10-13.
- [6] Ma Ning, Wang Hongbing, Liu Yijun, Wang Ying. *Research on the Trend Characteristics and Multidimensional Measurement of the Interdiscipline Development in China [J]*. *Journal of Graduate Education*, 2023 (3): 1-9.
- [7] Zhu Huawei. *Research on the Construction and Current Development of Interdisciplines in High-Level Universities in China: Based on a Survey and Analysis of 46 Graduate Schools [J]*. *Chinese Higher Education Research*, 2022 (3): 15-23.